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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

FOREST INVENTORY STATISTICS FOR THE JUNEAU TIMBER MANAGEMENT UNIT OF THE NORTH TONGASS NATIONAL FOREST

Forest Survey Report No. 1

by
A. P. Caporaso

(In-Service Use Only)

Alaska Forest Research Center
R. F. Taylor, Forester in Charge

March, 1957

M—5123

U. S. GOVERNMENT PRINTING OFFICE

8—7417

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CONTENTS

Page

FOREWORD..... i

HIGHLIGHTS..... 1

TABLES

1. Land area, by major classes of land by timber management blocks..... 3

2. Commercial forest land by ownership classes by timber management blocks..... 4

3. Area of commercial forest land, by forest types by timber management blocks..... 5

4. Area of commercial forest land by stand-size classes by timber management blocks..... 6

5. Net volume of live sawtimber and growing stock on commercial forest land, by ownership class..... 7

6. Net board foot volume of live sawtimber on commercial forest land by accessibility classes..... 7

7. Net volume of live sawtimber and growing stock on commercial forest land by stand-size class..... 8

8. Net board foot volume of live sawtimber on commercial forest land by stand-size class by timber management blocks..... 9

9. Volume of live merchantable sawtimber and growing stock on commercial forest land by species..... 10

10. Net board foot volume of live sawtimber on commercial forest land by species and by timber management blocks..... 11

11. Average defect and breakage percents by species..... 12

12. Net board foot volume of live sawtimber on commercial forest land by diameter class groups and species... 13

13. Net volume of all timber on commercial forest land by class of material and species group..... 14

14. Average net board foot volume per acre by various commercial forest land classes..... 15

CONTENTS (continued)

Page

APPENDIX

Explanation of terms..... A-1
Species tallied..... A-4
Forest survey procedures..... A-4
Accuracy of the estimates..... A-7
Coefficient of variation..... A-9
Estimated costs per acre by project phases..... A-10

FOREWORD

This is the first in a series of reports on the forest area and timber volume of Southeast Alaska. It is a product of the Forest Survey of Southeast Alaska carried on by the Alaska Forest Research Center in cooperation with the Timber Management Division of Region 10 of the U.S. Forest Service.

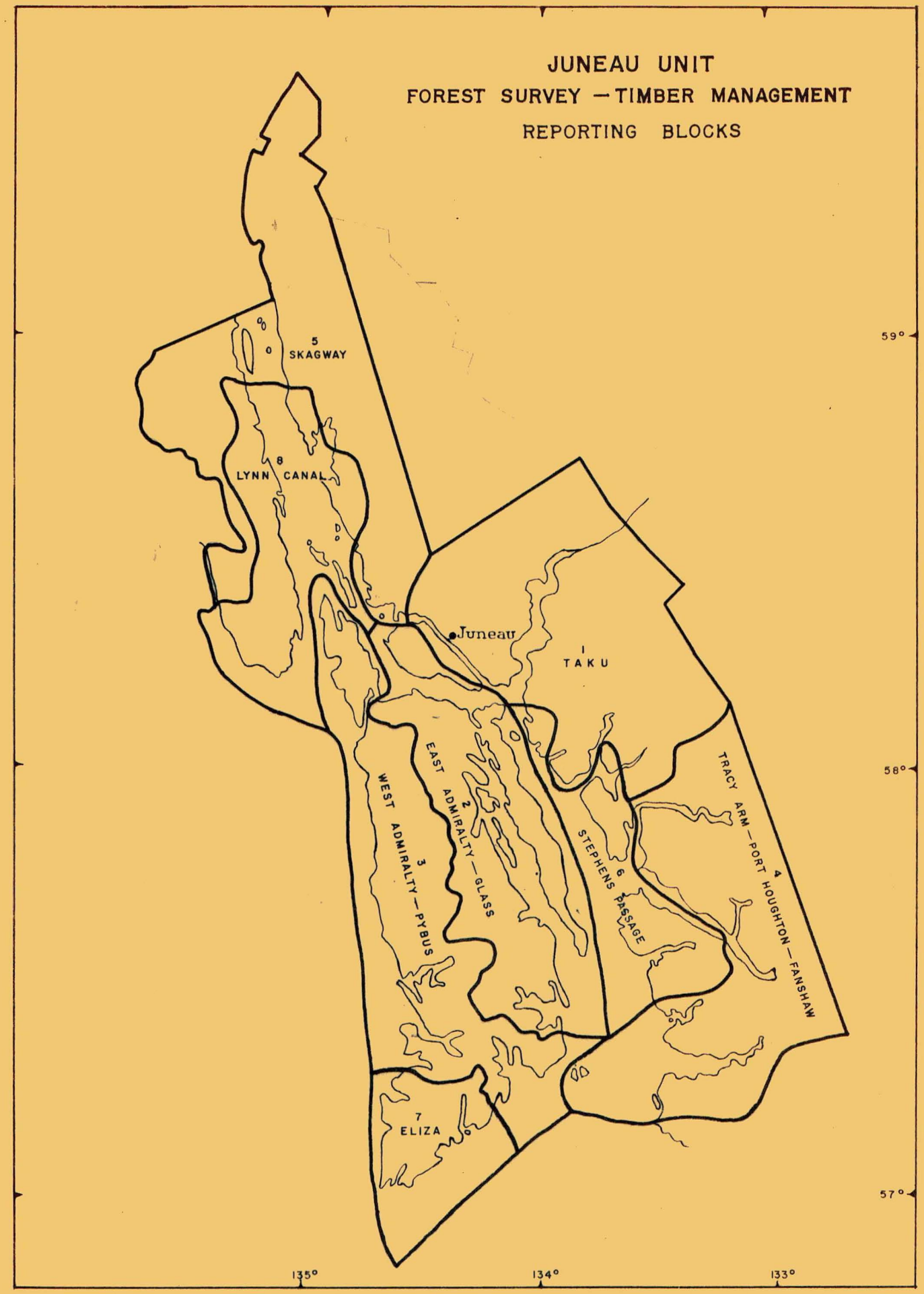
The resource facts contained herein provide reliable data on a timber management unit basis for the Region's long-range plans for timber production and for their guidance of forest industry development. These facts are also additive to the nation-wide survey being conducted by the Forest Service.

Funds for the conduct of the survey were supplied by both Region 10 and the Forest Survey. The aerial photos used were loaned by the Region. Field work was accomplished during the field season of 1955.

From initial planning to final compilation, these people worked on the inventory:

General Supervision:	A. P. Caporaso, Project Leader
Statistical Procedures and Field and Office Plan:	Harold E. Andersen, Alaska Forest Research Center; Roy A. Chapman, Washington Office; Floyd A. Johnson, Pacific Northwest Forest and Range Experiment Station; E. M. Hornibrook, California Forest and Range Experiment Station
Field and Office Work:	A. P. Caporaso, John Grove, Paul Haack, Henry Hays, Arland S. Harris, Thomas R. Jones, Russell McGregor, and Robert Gregory
Report:	A. P. Caporaso

Acknowledgement is also made of cooperation from personnel of the Regional Office, the Forest Supervisor and his staff of the North Tongass National Forest, and the Forest Management Research Division of the Alaska Forest Research Center.


JUNEAU UNIT
FOREST SURVEY — TIMBER MANAGEMENT
REPORTING BLOCKS
5
SKAGWAY
8
LYNN CANAL
Juneau
1
TAKU
2
EAST ADMIRALTY — GLASS
3
WEST ADMIRALTY — PYBUS
6
STEPHENS PASSAGE
4
TRACY ARM — PORT HOUGHTON — FANSHAW
7
ELIZA
59°
58°
57°
135°
134°
133°

HIGHLIGHTS

Areas

Forest area [1]

Less than half - 43 percent - of the 3,832,000 acres of land area of the Juneau Timber Management Unit is forested. About half - 49 percent - of the forested area qualifies as productive, or commercial, forest land. However, about 29 percent of the commercial forest land area is presently inaccessible under current logging practices and economic climate. Restocking areas and poletimber stands surrounded by accessible commercial sawtimber stands are also considered to be accessible. Of the 2,180,000 acres of nonforest land about 92 percent is located on the mainland portions of the unit. These areas are composed chiefly of ice fields, glaciers, and brushy and barren mountain tops.

Ownership

Ninety-eight percent of the commercial forest land area is in National Forests, of which only about 3,000 acres, or less than one percent, is reserved from timber cutting.

Forest types

The hemlock type occupies, by far, the largest area. Three-fourths of the commercial forest land area is in this type. Twenty-three percent is about equally divided between the Sitka spruce and the hemlock-Sitka spruce types. The remaining 2 percent is shared about equally between the cedar and hardwood types.

Forest stands

Sawtimber stands occupy 95 percent of the commercial forest land of which 94 percent is in old-growth, uneven-aged stands. Receding glaciers, by exposing new ground, account for a considerable portion of the 3 percent of the commercial forest land area in nonstocked and seedling-and-sapling stands. These areas are in various stages of restocking. In general, young-growth sawtimber and poletimber stands are relatively even-aged and comprise 8 percent of the area. A small number of these stands are a result of past logging and fire, but the origin of most of them can be traced to destructive winds - particularly in the northern half of the unit.

A significant indicator of the decadent condition of the old-growth stands is the high proportion - 13 percent - of the live sawtimber-size trees that are cull trees. These trees are of no present value to industry in Southeast Alaska.

1/ See definitions in Appendix.

Timber Volume 2/

Seventy percent of the more than 23-1/3 billion net board feet in the Juneau unit is considered to be presently accessible.

Eighty percent of the commercial accessible area is occupied by presently operable stands of more than 16,000 board feet per acre and they carry about 93 percent of the total board foot volume of commercial accessible forest stands. These stands average about 34,500 board feet per acre.

Two-thirds of the total board foot volume is in hemlock trees, with about 32 percent in Sitka spruce, 1 percent in Alaska-cedar, and the remaining 1 percent made up of lodgepole pine, subalpine fir, cottonwood and red alder. Most of the cottonwood is located on the bars and flats of the Taku River valley.

Old-growth sawtimber stands comprise about 94 percent of the total board foot volume, and in addition contain about 181 million board feet of salvable, standing dead sawtimber. These same stands contain about 84 percent of the poletimber volumes, or about 235 million cubic feet. Under present local economic conditions, however, these poletimber trees are not harvested; and since many will be destroyed from clearcutting logging operations, much of this volume can be considered lost from the inventory.

The 21-inch through 30-inch diameter class group contains the greatest percentage of the softwood sawtimber volume. This amounts to 39 percent or better than 9 billion board feet.

No estimates were made of the net volume of hemlock and Sitka spruce by log grades due to the very light sampling system used. This information when reported on a regional basis, however, will be more reliable.

2/ All board-foot volumes referred to herein are in terms of Scribner rule unless otherwise noted.

Table 1.--Land area by major classes of land by timber management blocks, Juneau Unit, 1955

Block	FOREST LAND						Nonforest Land 3/	Total all classes
	Commercial							
	Accessible	Inaccessible 1/	Total	Reserved 2/	Noncommercial	Total forest		
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
1. Taku	58,100	32,000	90,100	800	126,100	217,000	752,000	969,000
2. East Admiralty-Glass	89,400	26,200	115,600	1,000	185,100	301,700	69,800	371,500
3. West Admiralty-Pybus	159,800	55,200	215,000		189,300	404,300	86,600	490,900
4. Tracy Arm-Port Houghton-Fanshaw	45,800	22,600	68,400	1,200	61,700	131,300	526,600	657,900
5. Skagway	62,900	33,700	96,600		93,500	190,100	556,900	747,000
6. Stephens Passage	73,600	36,000	109,600		56,000	165,600	52,100	217,700
7. Eliza	27,600	5,700	33,300		52,500	85,800	17,200	103,000
8. Lynn Canal	61,300	27,600	88,900		67,800	156,700	118,800	275,500
Unit Total	578,500	239,000	817,500	3,000	832,000	1,652,500	2,180,000	3,832,500
Percent of Total	15	6	21	4/	22	43	57	100

1/ Productive forest land believed to be presently inaccessible under current logging practices and economic climate in Southeast Alaska.

2/ Classified as productive-reserved noncommercial forest land by the Forest Survey.

3/ Includes 8000 acres of water. These freshwater areas range from 10 to 40 acres in size and would be defined by the Bureau of Census as land but are classified as water according to Survey standards of area classification.

4/ Less than one percent.

Table 2.--Commercial forest land by ownership classes, by timber management blocks, Juneau Unit, 1955

Blocks	Ownership Class			
	National forest	BLM	Private	Total
	Acres	Acres	Acres	
1. Taku	78,900	7,400	3,800	90,100
2. East Admiralty-Glass	115,100		500	115,600
3. West Admiralty-Pybus	215,000		1/	215,000
4. Tracy Arm-Port Houghton-Fanshaw	68,400		1/	68,400
5. Skagway	92,400	3,600	600	96,600
6. Stephens Passage	108,900		700	109,600
7. Eliza	33,300		1/	33,300
8. Lynn Canal	87,500		1,400	88,900
Unit Total	799,500	11,000	7,000	817,500

1/ Less than 100 acres.

Table 3.--Area of commercial forest land by forest types and timber management blocks, Juneau Unit, 1955

Block	Forest Type and Symbol					
	Hemlock (H)	Hemlock-Sitka spruce (H-S)	Sitka spruce (S)	Cedar (C)	Hardwoods (D)	Total
	Acres	Acres	Acres	Acres	Acres	Acres
1. Taku	54,100	10,500	23,200	600	1,700	90,100
2. East Admiralty-Glass	92,600	14,500	7,300	600	600	115,600
3. West Admiralty-Pybus	175,400	28,200	11,400	1/	1/	215,000
4. Tracy Arm-Port Houghton-Fanshaw	56,000	7,700	2,900	1,800	1/	68,400
5. Skagway	55,600	11,200	26,400	1/	3,400	96,600
6. Stephens Passage	89,100	13,800	5,100	1,100	500	109,600
7. Eliza	25,800	3,800	3,100	600	1/	33,300
8. Lynn Canal	69,300	10,100	7,700	1,200	600	88,900
Unit Total	617,900	99,800	87,100	5,900	6,800	817,500
Percent of Total	75	12	11	1	1	100

1/ Small areas of this type may occur in this block but since no sample or ground plots were encountered, no estimates were made.

Table 4.--Area of commercial forest land by stand-size classes and timber management blocks, Juneau Unit, 1955

Block	Stand-size class and symbol					
	Old-growth sawtimber (4)	Young-growth sawtimber (3)	Poletimber (2)	Seedling-&-sapling (1)	Nonstocked and other (N)	Total
	Acres	Acres	Acres	Acres	Acres	Acres
1. Taku	62,600	12,100	2,700	2,400	10,300	90,100
2. East Admiralty-Glass	111,100	3,300	1,200	1/	1/	115,600
3. West Admiralty-Pybus	204,600	5,900	2,900	600	1,000	215,000
4. Tracy Arm-Port Houghton-Fanshaw	62,500	1,700	1,100	800	2,300	68,400
5. Skagway	73,400	11,200	3,200	3,600	5,200	96,600
6. Stephens Passage	105,200	3,400	300	700	1/	109,600
7. Eliza	30,400	1,900	500	500	1/	33,300
8. Lynn Canal	77,900	5,400	3,100	1,400	1,100	88,900
Unit Total	727,700	44,900	15,000	10,000	19,900	817,500
Percent of Total	89	6	2	1	2	100

1/ Small stands of this size class may occur in this block, but since no sample photo or ground plots were recorded, no estimates were made.

Table 5.--Net volume of live sawtimber and growing stock on commercial forest land, by ownership class, Juneau Unit, 1955

Ownership Class	Sawtimber	Growing stock
	Million board feet, Scribner rule	Million cubic feet
Federally owned or managed:		
National forest	22,867	4,462
Bureau of Land Management	315	61
Private:		
Farm	29	6
Other	172	33
All ownerships	23,383	4,562

Table 6.--Net board foot volume of live sawtimber on commercial forest land by accessibility classes, Juneau Unit, 1955

Class	Sawtimber	Percent
	Million board feet Scribner rule	
Accessible	16,312	70
Inaccessible	7,071	30
Total all classes	23,383	100

Table 7.--Net volume of live sawtimber and growing stock on commercial forest land, by stand-size class, Juneau Unit, 1955

Stand-size class & symbol	Sawtimber	Growing stock
	Million board feet, Scribner rule	Million cubic feet
Old-growth sawtimber (4)	21,936	4,259
Young-growth sawtimber (3)	1,319	265
Poletimber (2)	75	26
Seedling-and-sapling (1)	1/	1/
Nonstocked and other (N)	53	12
Total all classes	23,383 2/	4,562

1/ Less than one million.

2/ 1,922 million board feet has been deducted for felling breakage.

Table 8.--Net board foot volume of live sawtimber on commercial forest land by stand-size class and timber management blocks, Juneau Unit, 1955

Block	Stand-size classes and symbols					
	Old-growth sawtimber (4)	Young-growth sawtimber (3)	Poletimber (2)	Seedling-&-sapling (1)	Nonstocked and other (N)	Total
	Million board feet Scribner rule					
1. Taku	1,883	356	13	1/	27	2,279
2. East Admiralty-Glass	3,352	97	6	1/	1/	3,455
3. West Admiralty-Pybus	6,169	174	14	1/	3	6,360
4. Tracy Arm-Port Houghton-Fanshaw	1,880	50	6	1/	6	1,942
5. Skagway	2,213	329	16	1/	14	2,572
6. Stephens Passage	3,175	99	2	1/	1/	3,276
7. Eliza	918	56	3	1/	1/	977
8. Lynn Canal	2,346	158	15	1/	3	2,522
Total	21,936	1,319	75	1/	53	23,383 2/

1/ Less than one million board feet.

2/ 1,922 million board feet has been deducted for felling breakage.

Table 9.--Volume of live merchantable sawtimber and growing stock on commercial forest land by species, Juneau Unit, 1955

Species	Sawtimber		Growing stock
	Gross million board feet Scribner rule	Net million board feet Scribner rule	Net million cubic feet
Softwoods:			
Hemlock	20,188	15,545	3,109
Sitka spruce	8,662	7,536	1,381
Alaska-cedar	283	204	48
Lodgepole pine	28	23	5
Subalpine fir	8	5	1/
Total	29,169	23,313	4,543
Hardwoods:			
Cottonwood	52	49	9
Red alder	22	21	10
Total	74	70	19
Total all species	29,243	23,383 2/	4,562

1/ Less than one million cubic feet.

2/ 1,922 million board feet has been deducted for felling breakage.

Table 10.--Net board foot volume of live sawtimber on commercial forest land by species and timber management blocks, Juneau Unit, 1955

Block	Species							
	Hemlock	Sitka spruce	Cedar	Lodgepole pine	Fir	Cotton-wood	Red Alder	Total
	Million board feet Scribner rule							
1. Taku	1,148	1,080	10	1/	5	36	1/	2,279
2. East Admiralty-Glass	2,608	835	8	1/	1/	1/	4	3,455
3. West Admiralty-Pybus	4,420	1,881	32	23	1/	1/	4	6,360
4. Tracy Arm-Port Houghton-Fanshaw	1,516	396	19	1/	1/	2	9	1,942
5. Skagway	1,122	1,439	1/	1/	1/	11	1/	2,572
6. Stephens Passage	2,804	467	1	1/	1/	1/	4	3,276
7. Eliza	406	440	131	1/	1/	1/	1/	977
8. Lynn Canal	1,521	998	3	1/	1/	1/	1/	2,522
Total	15,545	7,536	204	23	5	49	21	23,383 2/

1/ This species may occur in this block but no volume estimate was made unless it occurred on the field plots.

2/ 1,922 million board feet has been deducted for felling breakage.

Table 11.--Average defect and breakage percents by species, Juneau Unit, 1955

Species	Average breakage (sawtimber)	Average percent defect in live merchantable sawtimber trees 1/	Average percent defect in all live sawtimber-size trees 2/
	Percent	Percent of gross board foot volume	Percent of gross board foot volume
Sitka spruce	2	13	15
Hemlock	9	23	34
Cedar	2	28	40
Lodgepole pine	0	18	18
Subalpine fir	0	6	6
Cottonwood	1	5	39
Red alder	2	4	18

1/ Estimates of defect for spruce, hemlock and cedar obtained from Kimmey, James W. Cull factors for Sitka spruce, western hemlock and western redcedar, Alaska Forest Research Center, Station Paper No. 6. Cull estimates for other species and breakage were cruiser's estimates.

2/ Defect in live merchantable sawtimber trees plus cull sawtimber-size trees.

Table 12.--Net board foot volume of live sawtimber on commercial forest land by diameter class groups and species group, Juneau Unit, 1955

Diameter class group	Species Group			
	Softwoods		Hardwoods	
	Million board feet Scribner rule	Percent	Million board feet Scribner rule	Percent
11.0" to 20.9" dbh	6,683	29	52	74
21.0" to 30.9" dbh	9,101	39	16	23
31.0" to 40.9" dbh	4,653	20	2	3
41.0" dbh and larger	2,876	12	1/	2/
Total all diameter classes	23,313 3/	100	70	100

1/ Less than 500,000 board feet.

2/ Less than one percent.

3/ 1,922 million board feet has been deducted for felling breakage.

Table 13.--Net volume of all timber on commercial forest land by class of material and species group, Juneau Unit, 1955

Class of material	Total	Softwoods	Hardwoods
	Million cubic feet	Million cubic feet	Million cubic feet
Growing stock			
Sawtimber trees			
Sawlog portion	4,013	4,001	12
Upper stem portion	270	268	2
Total	4,283	4,269	14
Poletimber trees	279	273	6
Total growing stock	4,562	4,542	20
Other material			
Sound cull trees	27	27	1/
Rotten cull trees	40	40	1/
Hardwood limbs	1/	--	1/
Salvable dead	29	29	1/
Total other material	96	96	2/
Total, all timber	4,658	4,638	20

1/ Less than 500,000 cubic feet.

2/ Less than one million cubic feet.

Table 14.--Average net board foot volume per acre by various commercial forest land classes, Juneau Unit, 1955

Item	Average net board foot volume per acre Scribner rule
Total commercial forest land	28,600
Total commercial accessible forest land	28,200
Total commercial inaccessible forest land	29,590
Commercial accessible stands 16,000 bd. ft./acre and over	34,530
Commercial accessible stands 20,000 bd. ft./acre and over	36,460
Commercial inaccessible stands 16,000 bd. ft./acre and over	34,720
Commercial inaccessible stands 20,000 bd. ft./acre and over	36,950
Old-growth sawtimber stands	30,140
Young-growth sawtimber stands	29,380
Poletimber stands	5,000

APPENDIX

EXPLANATION OF TERMS

Land-Use Classes

Forest land.--Includes (a) lands that are at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting influence on the climate or on the water regime; (b) land from which the trees described in (a) have been removed to less than 10 percent stocking, and which has not been developed for other use. (Forested tracts and islands of less than 10 acres and isolated strips of timber less than 120 feet wide are excluded.)

1. Commercial forest land - Forest land producing or capable of producing usable crops of industrial wood.

   a. Commercial accessible - Commercial forest land presently accessible and economically available now and which has not been withdrawn from use.

   b. Commercial inaccessible - Commercial forest land presently inaccessible and economically unavailable now and not withdrawn for specified purposes.

   c. Commercial reserved - Commercial forest land withdrawn from timber utilization through statute, ordinance or administrative order.

2. Noncommercial forest land - Forest land incapable of producing usable industrial wood because of adverse site conditions and not withdrawn for specified purposes.

3. Noncommercial reserved forest land - Noncommercial forest land withdrawn for specified purposes through statute, ordinance or administrative order.

Nonforest land.--Includes land which has never supported forest growth; land from which the forest has been removed to less than 10 percent stocking and has been developed for other use, such as agricultural, residential, or industrial; all land in thickly populated urban and suburban areas; and water classified by the Bureau of the Census as land. Glaciers, ice fields, marsh land above mean high tide, permanent brush fields, muskegs less than 10 percent stocked to trees of any size and barren mountain tops are examples of lands which have never supported forest growth.

Forest types

Commercial forest types

Forest types are classified according to the species or species group that accounts for the major portion of the stand in terms of gross board feet, Scribner, in sawtimber, cubic feet in poles and number of stems in seedling and sapling stands.

Sitka spruce.--Forests in which Sitka spruce is predominant.

Hemlock-Sitka spruce.--Forests in which Sitka spruce comprises 30 to 49 percent of the stand in association with predominant hemlock.

Hemlock.--Forests predominately hemlock except when Sitka spruce comprises 30 to 49 percent of the stand.

Cedar.--Forests predominately western redcedar or Alaska-cedar, singly or in combination.

Hardwood.--Forests predominately cottonwood or red alder, singly or in combination.

Noncommercial forest types

Scrub.--Forests characterized by open stands of stunted, limby, defective trees of no present or prospective value. All tree species may be present. Mature stands will net less than 8000 board feet per acre (Scribner rule).

1. Stands occupy swamp-like soils and contain a dense understory of blueberry and other shrubs.
2. Stands at the upper limits of tree growth.
3. Stands within the altitudinal range of merchantable timber but occupying sites too rocky and too sterile to produce merchantable timber.

Tree Classes

Sawtimber trees.--Live trees of commercial species at least 11.0-inches d.b.h. with at least 25 percent of their gross board foot volume free from rot or other defect and that contain at least one merchantable sawlog. A merchantable sawlog is not less than 16 feet long, at least 6-inches d.i.b. at the small end for softwoods and 8-inches d.i.b. for hardwoods, and which after deductions for defect contains a net scale of 33-1/3 percent. However, for any log to be merchantable it must contain at least 20 board feet (Scribner rule). Merchantable height was based on the number of 16 foot logs in softwoods to a top d.i.b. of 40 percent of d.b.h., except in the case of small trees where the minimum top is 6 inches. For hardwoods it was the number of 8 foot logs to a minimum top of 8-inches d.i.b. for small trees and 40 percent of d.b.h. for large trees.

Poletimber trees.--Live trees 5.0-inches to, but not including, 11.0-inches d.b.h. These trees are of sufficiently good form and condition to indicate that they will grow into merchantable sawtimber trees.

Seedling and sapling trees.--Live trees of commercial species less than 5.0-inches d.b.h. and of sufficiently good form and vigor to indicate that they will grow into merchantable sawtimber trees.

Cull trees.--Live trees at least 5.0-inches d.b.h. that do not qualify as sawtimber or poletimber trees due to poor form, limbiness, rot or other defect.

Salvable dead trees.--Standing dead sawtimber-size trees containing at least one merchantable sawlog and containing at least 50 percent of the tree gross volume in sound material.

Stand-size Classes

Sawtimber stands.--Forest stands in which the minimum volume for coniferous types is 8,000 net board feet (Scribner) per acre in merchantable trees 11.0-inches and larger. For hardwood sawtimber stands the minimum volume is 4,000 net board feet (Scribner) per acre.

1. Old-growth.--Sawtimber stands in which the majority of volume is in sawtimber trees more than 150 years of age.

2. Young-growth.--Sawtimber stands in which the majority of volume is in sawtimber trees less than 150 years of age.

Poletimber.--Stands failing to meet the sawtimber stand specification, but at least 10 percent stocked with poletimber and larger trees and with at least half the minimum stocking in poletimber trees.

Seedling and sapling.--Stands not qualifying as either sawtimber or poletimber, but having at least 10 percent stocking of trees of commercial species and with at least half the minimum stocking in seedlings-and-saplings.

Nonstocked and other areas.--Commercial forest land not qualifying for any other class.

Volume Estimates

Board-foot volume.--Net volume in board feet, measured by the Scribner rule, of that portion of live sawtimber trees between stump and the upper limit of merchantability for sawlogs. Volume deductions have been made for defects and breakage. Cull factors for hemlock, spruce and cedar were obtained from Station Paper No. 6, Alaska Forest Research Center. Cull for other species and breakage were cruiser's estimates.

Cubic-foot volume:

Growing stock.--Net volume in cubic feet of live merchantable sawtimber trees and live poletimber trees of commercial species from stump to a minimum 4.0-inch top (of central stem) inside bark.

All timber volume.--Net volume in cubic feet of live poletimber trees, live and salvable dead sawtimber trees and cull trees of commercial species from stump to a minimum 4.0-inch top inside bark. Includes also the volume of all hardwood limbs to a minimum diameter of 4.0-inches inside bark.

SPECIES TALLIED 1/

The following commercial tree species were tallied in the Juneau Timber Management Unit. Other tree species may occur in this area, but unless they were tallied on the field plots they were not included in the following list.

Softwoods:	Sitka spruce	- Picea sitchensis
	Hemlock	
	Western hemlock	- Tsuga heterophylla
	Mountain hemlock	- Tsuga mertensiana
	Western redcedar	- Thuja plicata
	Alaska-cedar	- Chamaecyparis nootkatensis
	Lodgepole pine	- Pinus contorta
	Subalpine fir	- Abies lasiocarpa
Hardwoods:	Black cottonwood	- Populus trichocarpa
	Red alder	- Alnus rubra

FOREST SURVEY PROCEDURES

The data presented herein are based on information obtained from aerial photographs and from sample plots examined on the ground and by aerial reconnaissance.

Photo-interpretation plots were first marked off on 1:40,000 vertical aerial photographs of the area using a template designed for this project. Sufficient plots were distributed systematically over photographs of the entire unit to meet the requirements of an allowable sampling error of 3 percent per million acres of commercial forest land in terms of one standard error. A total of 5,830 photo dots were examined by photointerpreters.

1/ Little, Elbert L., Jr. Check list of native and naturalized trees of the United States (including Alaska). U. S. Dept. Agr., Agr. Handbook 41, 472 pp. 1953.

First, the 10 acres surrounding each plot were classified as either forest or nonforest. Plots classified as forest were then transferred to 1:20,000 18° obliques of the unit for more intensive examination since this scale is better suited for more intensive forest examination. Next, the forest plots were further classified as to commercial or noncommercial. Finally, the commercial forest plots were stratified according to type, stand-size and density by management blocks. The proportion of plots in each class is multiplied by total land area to obtain the area of each class.

To determine the accuracy of the office photo classification a sample of photo plots was checked in the field. A predetermined number of photos were selected at random and all of the plots on each photo, called a cluster, were examined. The number of photo clusters to be examined was determined by Chapman's formula:

$$\left(\frac{S_{Paf}}{P_{af}}\right)^2 = \left[\frac{\sum_{i=1}^{k} N_{if}\,(1-P_{if})}{\left(\sum_{i=1}^{k} n_{if}\right)^2}\right] + \left[C^2_{n'_{if}} + C^2_{n'_{if}} - 2r_{(n'_{if})\,(n_{if})}\,C_{n'_{if}}\,C_{n_{if}}\right]\left[\frac{k-m}{k}\right]\frac{1}{m}$$

in which:

m = number of clusters to be checked

$\frac{S_{Paf}}{P_{af}}$ = relative error of proportion in commercial forest

k = total number of photos to give complete coverage

ni = number of points examined in the i-th cluster

n_{if} = number of points classed as commercial forest land

$C_{n_{if}}$ = coefficient of variation of the n_{if}

n'_{if} = number of points examined in the field

P_{if} = proportion in commercial forest land

$C_{n'_{if}}$ = coefficient of variation of the n'_{if}

$r_{(n'_{if})(n_{if})}$ = correlation coefficient between n_{if} and n'_{if}

Areas determined by photo-interpretation are corrected by applying a factor or ratio as determined from the comparison of photo and field classification of the random sample selected for field checking. A total of 485 photo classifications were checked in the field.

Field crews examined a sample of commercial forest land photo plots on the ground to collect species and volume data. Sufficient plots were selected at random to attain a specified level of statistical accuracy. The survey was designed for maximum efficiency in estimating total volume to meet the requirements of the Timber Management Division of Region 10 and the national survey. The allowable error for Region 10 requirement is 5 percent of total board foot volume per unit and for the national survey 10 percent per one billion cubic feet of growing stock per survey sub-region.

The number of commercial forest land ground plots selected at random was determined by using Johnson's formula:

$$E^2 = \frac{C^2}{n} + \frac{q}{mp}$$

where:

E = allowable error
C = coefficient of variation
n = number of ground plots
m = number of photo plots
p = proportion of photo plots on commercial forest land
q = proportion of photo plots on nonforest and noncommercial forest land

A total of 164 photo plots were examined on the ground.

Number of plots examined by timber management block, Juneau Unit, 1955

Block	Photo plots	Ground plots	Check plots
1. Taku	1,474	16	108
2. East Admiralty-Glass	565	26	58
3. West Admiralty-Pybus	747	50	68
4. Tracy Arm-Port Houghton-Fanshaw	1,001	13	74
5. Skagway	1,136	14	88
6. Stephens Passage	331	22	34
7. Eliza	157	6	14
8. Lynn Canal	419	17	41
Total	5,830	164	485

Plot volumes were computed for both the accessible and inaccessible commercial forest land strata. Gross volume Scribner rule less cull and less breakage produced net board-foot volume. The average net volume per acre for each class was then calculated and multiplied by total acreage for each to obtain total volume.

To obtain growing-stock volume the total board-foot volume of the merchantable sawlog portion of the trees with no deduction for breakage, was converted to cubic feet from a conversion factor developed from tree measurement data. From the same data source a ratio for the volume in tops or upper stem was developed and applied to the total cubic foot volume of the sawlog portion. The volume in the sawlog portion plus upper stem plus poles produced growing stock volume.

ACCURACY OF THE ESTIMATES

Errors which affect the accuracy of the area and volume estimates in this report may arise from two sources:

1. Non-sampling errors.--These are human mistakes in judgment, measurement, recording, or arithmetic. There is no practical method of finding out just how often such errors occur. These errors are kept to a minimum, however, by a diligent effort to maintain a high degree of accuracy in the collection and compilation of data and closely checking all phases of the work.

2. Sampling errors.--These errors arise from using sampling procedures rather than making a 100 percent inventory. These errors can be measured. They are the only measurable errors involved in computing the reliability of the estimates.

Accuracy of the forest-area estimates.--Statistical analysis of the forest area provided the following sampling errors:

Forest-land class	Area	Sampling error
	Thousand acres	Percent
Commercial accessible	579	3.0
Commercial inaccessible	239	5.1
Total commercial	818	2.5
Noncommercial	835	2.5

The probabilities are two out of three that the actual commercial forest-land area is within ± 2.5 percent of the estimated acreage. The standard error per equivalent million acres of commercial forest land area was ± 2.3 percent.

The area sampling error was calculated from the formula

$$SE = \frac{\sqrt{\frac{PQ}{n}}}{P}$$

in which:

P = proportion of total area in any particular class
Q = 1-P
n = total number of photo plots

Accuracy of the timber volume estimates.--Statistical analysis of the timber volume provided the following sampling errors:

Commercial forest	Growing stock		Sawtimber	
	Volume	Sampling error	Volume	Sampling error
	Million cu.ft.	Percent	Million bd.ft. Scribner rule	Percent
Accessible	--	5.1	16,312	5.5
Inaccessible	--	10.2	7,071	10.9
Total	4,562	4.6	23,383	4.9

The probabilities are two out of three that the actual cubic-foot volume of growing stock is within ± 4.6 percent of the estimated total volume and that the actual sawtimber board-foot volume is within ± 4.9 percent of the estimated total volume. The standard error per one billion cubic feet was ± 9.8 percent.

The volume sampling error was calculated from the formula

$$E^2 = \frac{C^2}{n} + \frac{q}{mp}$$

in which:

E = error
C = coefficient variation
n = number of ground plots in a particular class
m = number of photo plots
p = proportion of photo plots on commercial forest land
q = 1-p

With each subdivision of the unit total, the percentage error increases so that small acreages and volumes may have large errors and therefore indicate only relative magnitudes. The following is a rough guide for estimating the sampling errors of various acreages and volumes of timber management blocks and groups of blocks.

Area	Sampling error	Volume	Sampling error
Thousand acres	Percent	Billion bd. ft.	Percent
500	3.2	15	6.1
250	4.5	10	7.5
100	7.2	5	10.6
50	10.2	1	23.7

The sampling error for various subdivisions of area and volume was calculated from the following formulae:

Area

$$SE_a = \frac{SE_A}{\sqrt{\frac{a}{A}}}$$

in which:

SE_A = sampling error of total area of the unit

A = total area of the unit

a = area of a particular subdivision of the unit

Volume

$$SE_v = \frac{SE_{Vt}}{\sqrt{\frac{v}{Vt}}}$$

in which:

SE_{Vt} = sampling error of total volume

Vt = total volume of the unit

v = volume of a particular subdivision of the unit

COEFFICIENT OF VARIATION

The coefficient of variation as determined from all field plots examined on commercial forest land was 48.36 percent based on net cubic-foot volume of growing stock and 52.64 percent based on net board-foot volume (Scribner) of sawtimber trees.

Estimated costs per acre by project phases, Juneau Unit

Project	Commercial forest land	Total forest land	Total land
	Cost/acre	Cost/acre	Cost/acre
Photo interpretation	0.97 cents	0.48 cents	0.21 cents
Typemapping	1.60 cents	0.81 "	0.35 "
Ground plots	4.08 "	2.02 "	0.87 "
Compilation	0.38 "	0.19 "	0.08 "
Misc. field & office duties	0.92 "	0.45 "	0.19 "
Overhead	1.39 "	0.69 "	0.03 "
Administration, supervision, planning and report writing	1.47 "	0.73 "	0.03 "
Misc. charges & expenditures	0.97 "	0.48 "	0.21 "
Total	11.78 "	5.85 "	1.97 "